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ABSTRACT

Biology 30 is a twelfth-grade biology course for students in Alberta, Canada. This document is a final test for the course. Intended for administration during January 1985, it contains 80 multiple-choice questions and seven written-response problems. Two-and-one-half hours are allowed for completing the test. No answer key is included since scoring is done by the province education department. (JN)

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GRADE 12 DIPLOMA EXAMINATION

Biology 30

January 1985

Alberta
EDUCATION

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GRADE 12 DIPLOMA EXAMINATION
BIOLOGY 30

DESCRIPTION

Time: 2½ hours

Total possible marks: 100

This is a **CLOSED-BOOK** examination consisting of two parts:

PART A: 80 multiple-choice questions each with a value of 1 mark.

PART B: Seven written-response questions for a total of 20 marks.

GENERAL INSTRUCTIONS

Fill in the information on the answer sheet as directed by the examiner.

For multiple-choice questions, read each carefully and decide which of the choices BEST completes the statement or answers the question. Locate that question number on the answer sheet and fill in the space that corresponds to your choice. USE AN HB PENCIL ONLY.

Example

This examination is for the subject area of

A. Chemistry
B. Biology
C. Physics
D. Mathematics

Answer Sheet

A	B	C	D
①	●	③	④

If you wish to change an answer, please erase your first mark completely.

For written-response questions, read each carefully, show all your calculations, and write your answer in the space provided in the examination booklet.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work.

DO NOT FOLD EITHER THE ANSWER SHEET OR THE EXAMINATION BOOKLET

The presiding examiner will collect the answer sheet and examination booklet for transmission to Alberta Education.

JANUARY 1985

PART A

INSTRUCTIONS

There are 80 multiple-choice questions with a value of one mark each in this section of the examination. Use the separate answer sheet provided and follow the specific instructions given.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work.

WHEN YOU HAVE COMPLETED PART A, PROCEED DIRECTLY TO PART B

DO NOT TURN THE PAGE TO START THE EXAMINATION UNTIL TOLD TO DO SO BY THE PRESIDING EXAMINER.

1. Cell membranes are composed mainly of

   A. proteins and lipids
   B. lipids and carbohydrates
   C. nucleic acids and proteins
   D. carbohydrates and nucleic acids

2. A certain mutant strain of cancer cells has abnormal mitochondria. The resultant deficiency in these cells is related to

   A. protein synthesis
   B. energy production
   C. intracellular transport
   D. intracellular digestion

3. A cell organelle was analysed chemically and found to contain ribonucleic acid (RNA) and protein. The cell organelle was most likely a

   A. ribosome
   B. membrane
   C. lysosome
   D. mitochondrion

4. A cell will self-destruct when there is a breakdown of the membrane surrounding the

   A. vacuole
   B. lysosome
   C. ribosome
   D. mitochondrion

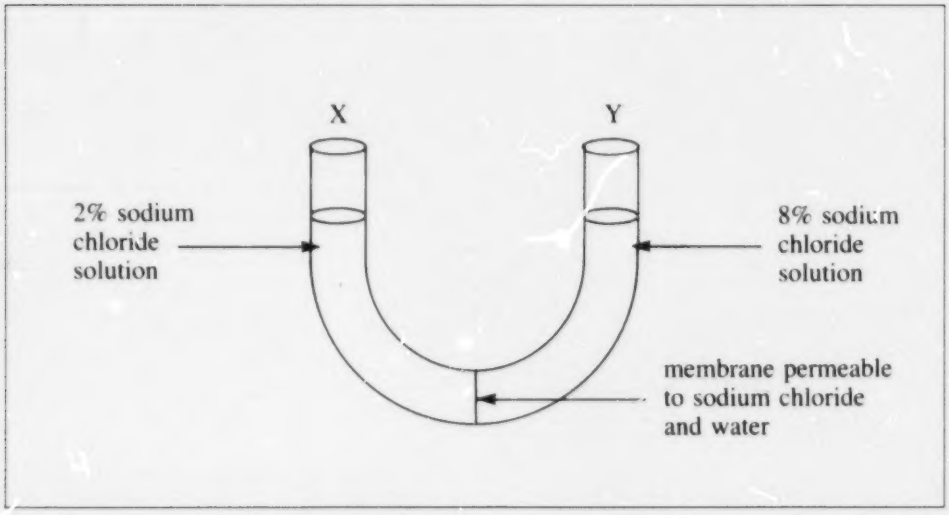
5. A cell that has a higher concentration of a particular mineral ion in its cytoplasm than in the surrounding medium results from

   A. osmosis
   B. diffusion
   C. endocytosis
   D. active transport

6. Onion odors spread through the air partially by

   A. osmosis
   B. diffusion
   C. active transport
   D. ionic attraction

Use the following information to answer question 7.



7. A U-tube was set up as shown in the diagram. The sodium chloride was dissolved in water. After 4 h what net movement had occurred?

A. Sodium chloride moved from Y to X; water moved from Y to X.
B. Sodium chloride moved from Y to X; water moved from X to Y.
C. Sodium chloride moved from X to Y; water moved from Y to X.
D. Sodium chloride moved from X to Y; water moved from X to Y.

---

8. The site of amylase synthesis would be the

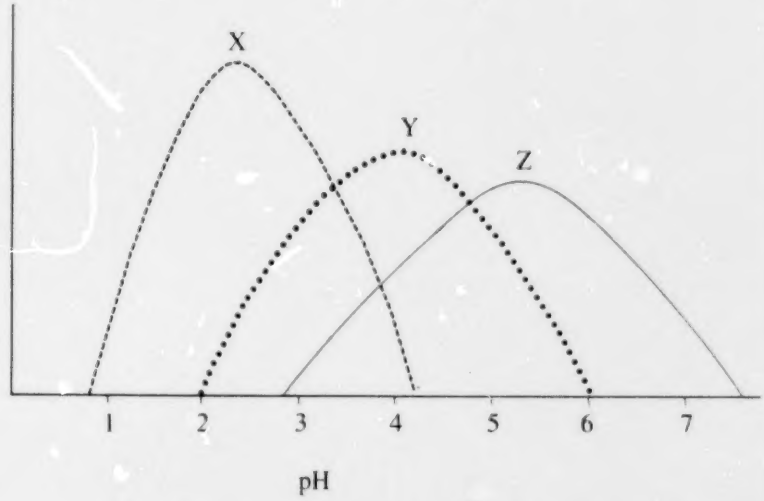
A. ribosome
B. centriole
C. mitochondrion
D. Golgi apparatus

9. An inhibitor molecule bonding to the active site of an enzyme would

A. stop the enzymatic action
B. speed up the anabolic reaction
C. cause the enzyme to break down
D. have no effect on the enzyme's action

Use the following information to answer question 10.

This graph shows the relationship between pH and degree of efficiency for three different enzymes.



10. If enzymes X, Y, and Z are all necessary to a specific biochemical reaction, what is the best pH range for this reaction?

A. 2 - 3
B. 3 - 4
C. 4 - 5
D. 5 - 6

---

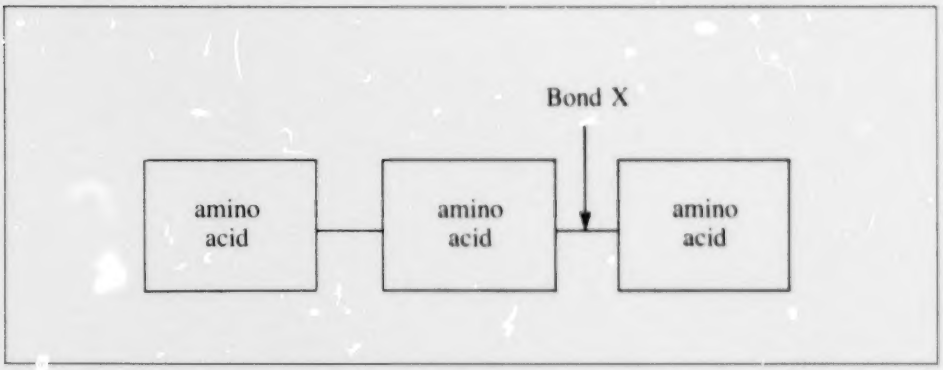
11. A protein could be distinguished from other substances by its reaction with

A. iodine
B. Sudan IV
C. Biuret solution
D. Benedict's reagent

12. A characteristic common to lipids and proteins is that they both

A. are soluble in water
B. contain nitrogen atoms
C. are found in the cell membrane
D. can be broken down by the removal of water

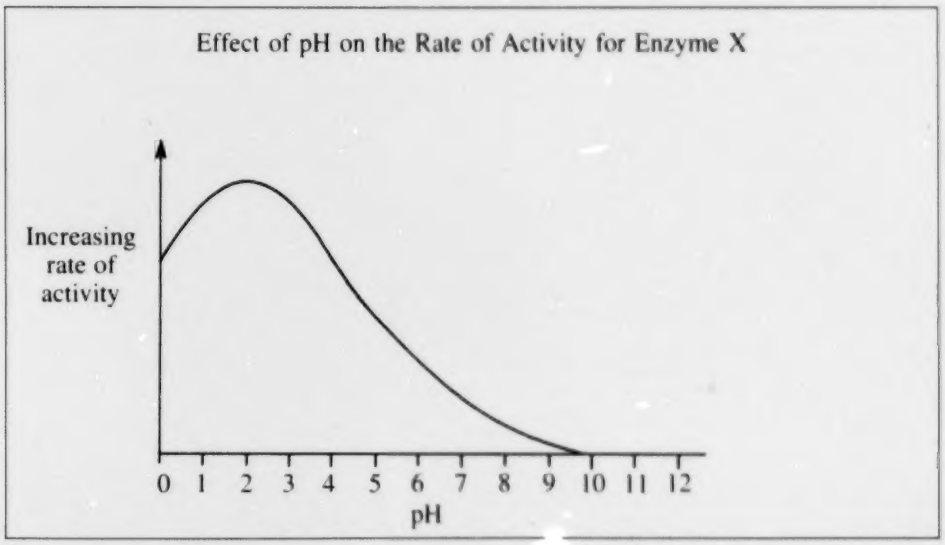
Use the following information to answer question 13.



13. The enzyme required to break bond X would be

A. bile
B. pepsin
C. lipase
D. amylase

Use the following information to answer question 14.

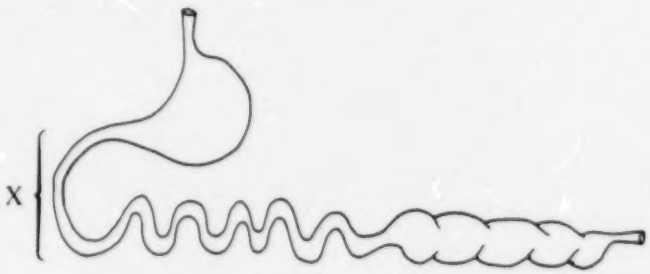


14. Enzyme X would be most active in the

A. mouth
B. stomach
C. small intestine
D. large intestine

Use the following information to answer question 15.

Digestive Tract



15. Substances secreted into the structure labelled X are produced by which pair of organs?

A. Liver and spleen
B. Liver and pancreas
C. Appendix and spleen
D. Pancreas and appendix

---

16. Two important functions of the large intestine are the

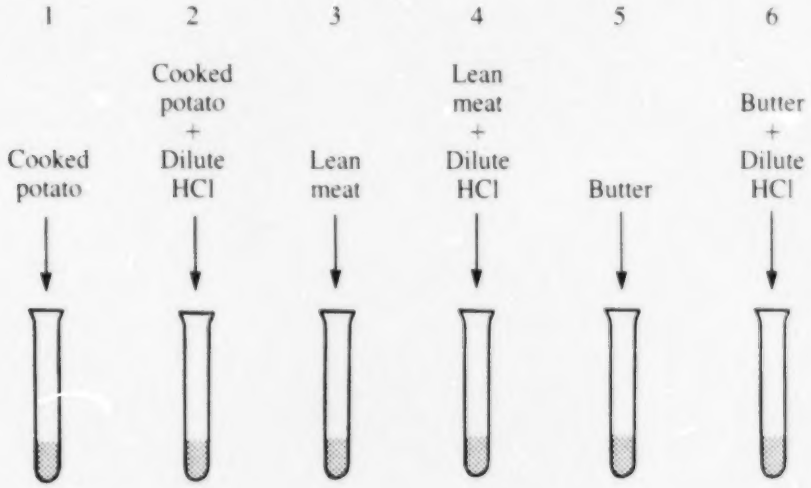
A. digestion and elimination of minerals
B. transportation and digestion of minerals
C. digestion of lipids and elimination of feces
D. absorption of water and elimination of feces

17. The process of breaking down glucose molecules results in the production of

A. starch
B. protein
C. deoxyribonucleic acid (DNA)
D. adenosine triphosphate (ATP)

Use the following information to answer questions 18 to 21.

In an experiment, a small amount of an UNKNOWN enzyme from a dog's digestive tract was mixed with different foods in six separate test tubes, three of which contained hydrochloric acid (HCl). Each test tube was incubated at 37°C for 12 h.



At the end of the experiment, only test tube 4 showed a decrease in the amount of food present.

18. The data indicates that the enzyme extracted probably came from the dog's

A. mouth
B. stomach
C. large intestine
D. small intestine

19. If the contents of test tube 4 were heated to 95°C, then reduced to body temperature, the reaction as described in the original experiment would

A. cease
B. be unaffected
C. proceed more slowly
D. proceed more rapidly

20. The enzyme involved in the digestion of the meat was MOST likely

A. lipase
B. maltase
C. amylase
D. protease

21. The necessary environment to make this enzyme active would seem to be

A. a basic solution
B. a saline solution
C. a neutral solution
D. an acidic solution

---

22. The function of the mechanical digestion of food is to

A. decrease peristaltic action
B. expose more surface area for chemical action
C. break down enzymes so that they are able to function
D. break down food so that it can be absorbed immediately

23. A decrease in blood pressure will initially result in

A. an increased heart rate
B. dilation of blood vessels
C. a decreased breathing rate
D. increased filtration at the glomerulus

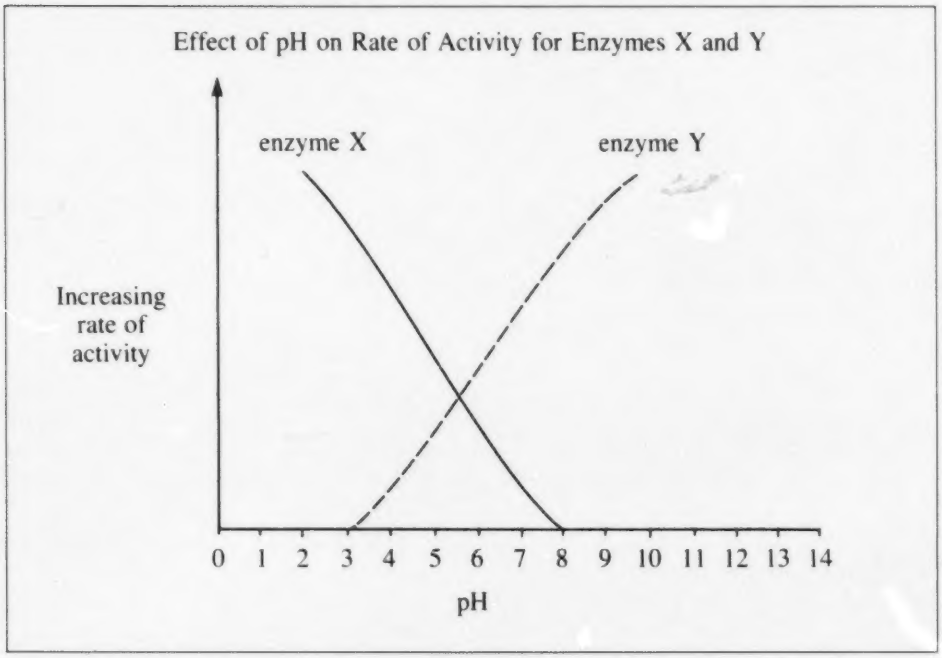
24. Both the lymphatic and venous transport systems

A. produce blood platelets
B. aid in the clotting process
C. carry red blood cells to the heart
D. utilize skeletal muscle contractions to move their fluids

25. The receptors that respond to changes in blood pressure are located in the

A. veins
B. arterioles
C. aorta and carotid arteries
D. capillaries and lymph system

Use the following information to answer question 26.

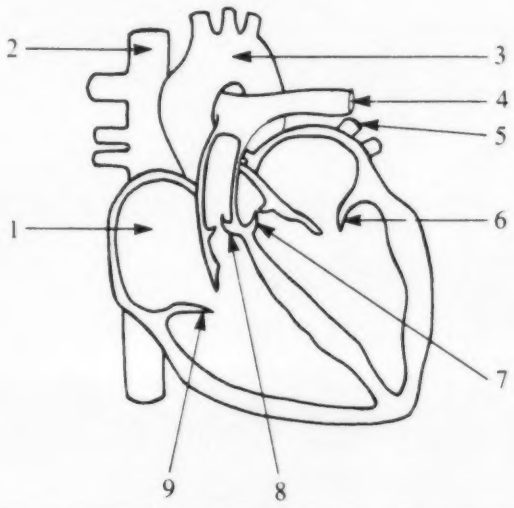

Effect of pH on Rate of Activity for Enzymes X and Y
enzyme X
enzyme Y
Increasing rate of activity
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14
pH

26. The fat in a hamburger would be digested by enzyme

A. Y, which works best in the stomach
B. X, which works best in the stomach
C. X, which works best in the small intestine
D. Y, which works best in the small intestine

Use the following information to answer questions 27 to 29.

Human Heart



27. The vein carrying oxygenated blood is numbered

A. 2
B. 3
C. 4
D. 5

28. The contraction of the ventricles results in the closure of the structures numbered

A. 7 and 8
B. 8 and 9
C. 6 and 7
D. 6 and 9

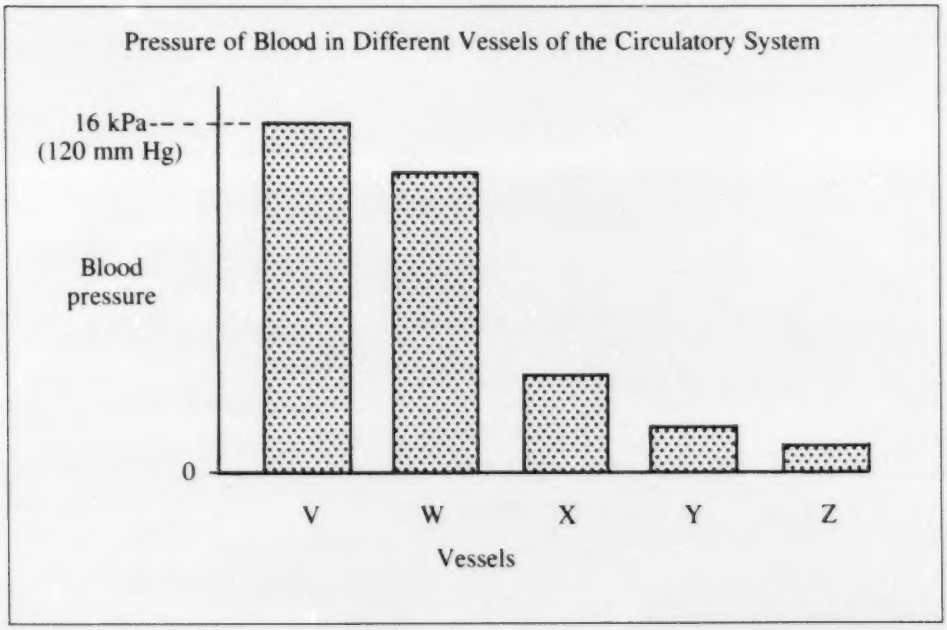
29. A heart murmur caused by leaking valves would occur through damage to the structures numbered

A. 1 or 7
B. 6 or 9
C. 8 and 3
D. 2 and 3

30. A high level of CO_2 in a localized area of the body would cause a

A. rise in blood pressure
B. slowing of the heartbeat
C. dilation of the arterioles
D. slowing of the breathing rate

Use the following information to answer questions 31 and 32.



31. Which section of the graph represents the area where the greatest amount of oxygen diffuses into tissue cells?

A. W
B. X
C. Y
D. Z

32. Section V of the graph represents blood travelling through

A. a vein
B. an artery
C. a capillary
D. a lymph vessel

33. When antigen A is present on a person's red blood cells, the person can produce

A. antibody A
B. antibody B
C. no antibodies
D. antibodies A and B

34. The structure that is composed mainly of lymphatic tissue is the

A. liver
B. tonsil
C. thyroid
D. pancreas

35. Plasma continually leaks from the capillaries into the interstitial fluid. In spite of this loss, blood plasma levels are maintained by the

A. regular intake of liquids to replace lost body fluids
B. return of fluid by the lymph vessels to the bloodstream
C. active transport of water against the concentration gradient
D. drawing back of plasma into lymphatic vessels by the pumping action of the heart

36. The alveolar walls are moist so that

A. germs can be trapped
B. water vapor can be exhaled
C. water vapor can be inhaled
D. oxygen can diffuse through the membranes

Use the following information to answer questions 37 and 38.

Subject	Tidal Volume* (mL)	Vital Capacity** (mL)	Respiratory Rate of Subject at Rest (breaths/min)
V (normal)	500	5 000	18
W	500	4 000	20
X	400	2 000	40
Y	550	5 000	15
Z	550	6 500	15

*Tidal volume is a measure of the volume of air inhaled (or exhaled) during normal breathing.
**Vital capacity is a measure of the maximum possible volume of air inhaled (or exhaled).

37. The subject most likely suffering from emphysema is

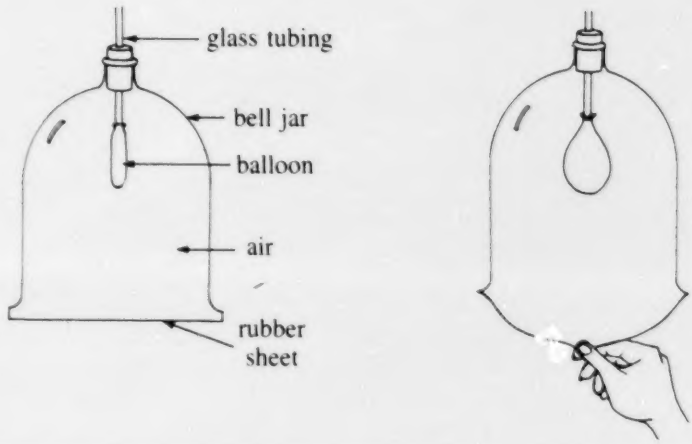
A. W
B. X
C. Y
D. Z

38. The subject who is most likely a marathon runner is

A. W
B. X
C. Y
D. Z

Use the following information to answer question 39.

Model to Show Mechanics of Breathing



39. Pulling down on the rubber sheet that covers the bottom of the jar causes air to rush into the balloon because air pressure in the

A. jar is reduced
B. jar is increased
C. balloon is reduced
D. balloon is increased

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40. Most carbon dioxide in the blood is carried in the form of

A. carbaminohemoglobin
B. carbonic acid (H_2CO_3)
C. bicarbonate ions (HCO_3^-)
D. carbon dioxide molecules

41. It is impossible to suffocate by holding your breath because

A. an increase in CO_2 levels stimulates the respiratory centres of the brain
B. the voluntary muscles that you use when you hold your breath become fatigued and relax
C. a decrease in O_2 levels stimulates the heart muscles and causes an increase in circulation
D. a decrease in CO_2 levels causes an increase in the rate at which O_2 diffuses across the alveolar membranes

42. In comparison with aerobic respiration, anaerobic respiration

A. requires oxygen and releases less energy
B. requires oxygen and releases more energy
C. does not require oxygen and releases less energy
D. does not require oxygen and releases more energy

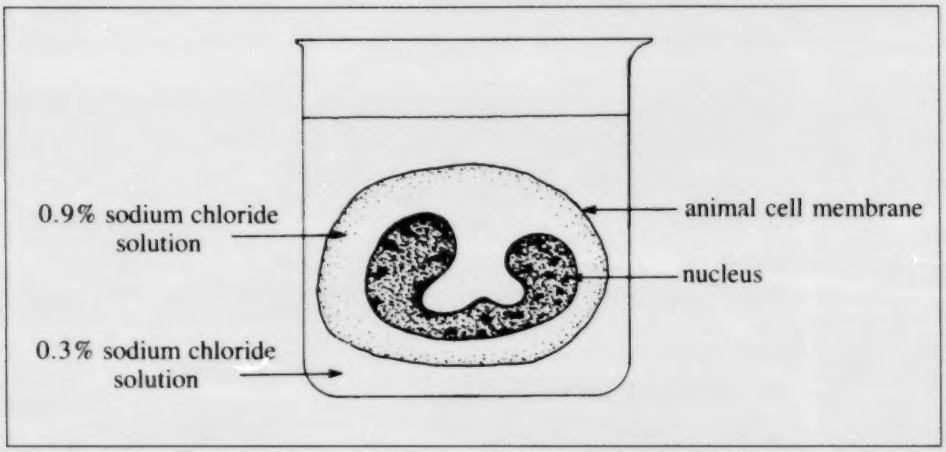
43. In cellular respiration, electrons move successively from

A. higher energy levels to lower energy levels
B. lower energy levels to higher energy levels
C. more stable compounds to less stable compounds
D. weak electron donors to stronger electron donors

44. The greatest number of adenosine triphosphate (ATP) molecules is produced during respiration when the end-product is

A. water
B. oxygen
C. acetic acid
D. pyruvic acid

Use the following information to answer question 45.

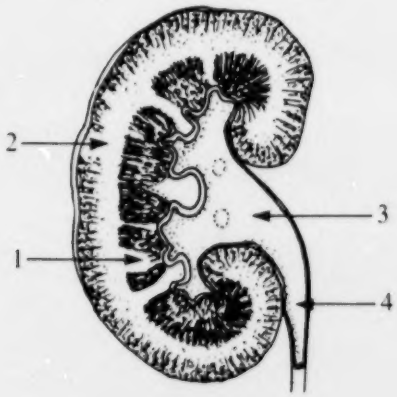


45. For the situation to be maintained,

A. hydrogen ions must act as the carriers
B. the sodium chloride must be fat-soluble
C. adenosine triphosphate (ATP) must be available
D. the cell membrane must be permeable to sodium chloride

Use the following information to answer question 46.

Cross-Section of a Kidney



46. Filtration occurs in the region labelled

A. 1
B. 2
C. 3
D. 4

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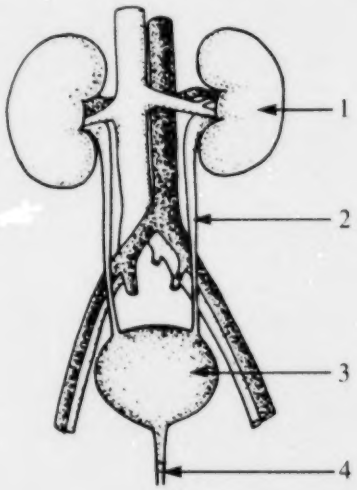
47. Aldosterone regulates body fluid levels by promoting the reabsorption of

A. urea
B. glucose
C. sodium ions
D. amino acids

Use the following information to answer question 48.

Human Urinary System



48. In the diagram, label 2 represents the

A. ureter
B. kidney
C. urethra
D. urinary bladder

---

49. If the urine of a healthy person were analysed, there would be only trace amounts of

A. water
B. glucose
C. mineral salts
D. nitrogenous wastes

50. When the pituitary gland releases an increased amount of antidiuretic hormone (vasopressin), it causes

A. reduced urine volume
B. increased urine volume
C. reduced water reabsorption by the capillaries
D. decreased permeability of the nephrons to water

Use the following information to answer questions 51 to 53.

The chart illustrates a content analysis of three separate fluids found in the kidney of Subject X.

Fluid	Substance (g/100mL)					
	Protein	Urea	Amino Acids	Glucose	Uric Acid	Inorganic Salts
Blood Plasma	8	0.04	0.05	0.100	0.004	0.72
Glomerular Filtrate	—	0.04	0.05	0.100	0.004	0.72
Urine	—	2.00	—	trace	0.050	1.50

51. Evidence of water reabsorption from the nephron would best be provided by the data for

A. urea
B. protein
C. glucose
D. amino acids

52. The statement "Amino acids are reabsorbed from the nephron" is

A. a restatement of the data presented
B. a reasonable interpretation of the data
C. an interpretation contradicted by the data
D. a statement unrelated to the data presented

53. The statement "The kidney of Subject X appears healthy" is

A. a restatement of the data presented
B. a reasonable interpretation of the data
C. an interpretation contradicted by the data
D. a statement unrelated to the data presented

54. Secretions from the endocrine glands are able to reach target organs because

A. they are controlled by the pituitary
B. the glands are situated throughout the body
C. the hypothalamus directs hormone production
D. hormones are secreted directly into the blood

55. Which gland produces insulin?

A. Adrenal
B. Thyroid
C. Pancreas
D. Pituitary

56. Sensors responsible for receiving environmental information are called

A. ganglia
B. effectors
C. receptors
D. motor neurons

57. A higher glucose concentration in the blood results from decreased levels of

A. insulin and thyroxin
B. glucagon and insulin
C. glucagon and adrenalin
D. adrenalin and thyroxin

58. The negative feedback sequence for the regulation of thyroxin is

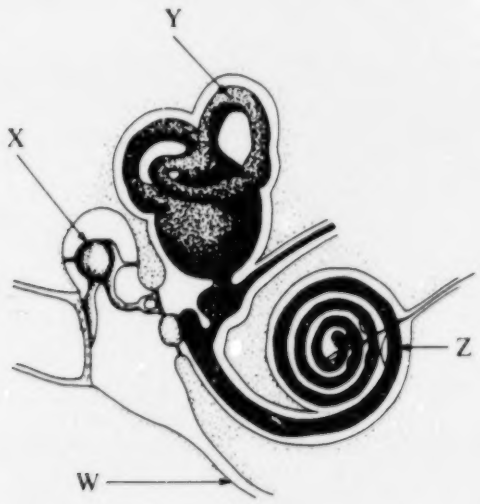
A. low thyroxin → less thyroid stimulating hormone → less thyroxin
B. high thyroxin → less thyroid stimulating hormone → less thyroxin
C. high thyroxin → more thyroid stimulating hormone → less thyroxin
D. low thyroxin → more thyroid stimulating hormone → less thyroxin

59. The eye's ability to focus results from

A. the refractive power of the iris
B. changes in the shape of the lens
C. changes in the shape of the fovea
D. the concentration of cones in the fovea

Use the following information to answer questions 60 and 61.

Structure of the Human Ear



60. The portion labelled Z represents the

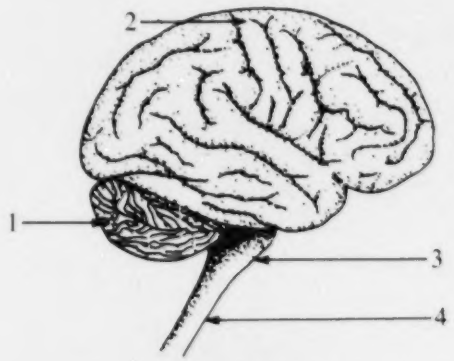
A. cochlea
B. ossicles
C. Eustachian tube
D. semicircular canals

61. Astronauts who have experienced weightlessness often suffer side-effects that result in balance problems. Therefore, weightlessness probably affects the portion of the ear labelled

A. W
B. X
C. Y
D. Z

Use the following information to answer questions 62 and 63.

The Human Brain



62. The structure that co-ordinates motor activity is numbered

A. 1
B. 2
C. 3
D. 4

63. The structure that regulates heartbeat and respiration is numbered

A. 1
B. 2
C. 3
D. 4

---

64. If one is nearsighted, the image is focused

A. on the retina
B. behind the retina
C. on the optic nerve
D. in front of the retina

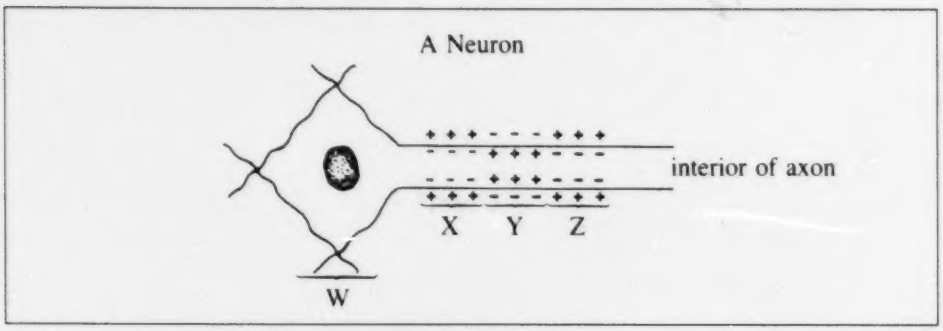
65. Structures that carry nerve impulses to the central nervous system are called

A. motor neurons
B. sensory neurons
C. synaptic neurons
D. association neurons

66. An enzyme released at the synapse that prevents continuous stimulation of the dendrite is

A. amylase
B. serotonin
C. acetylcholine
D. cholinesterase

Use the following information to answer questions 67 and 68.



67. Sodium ion concentrations are greatest

A. inside at X
B. outside at Y
C. inside at Z and outside at X
D. outside at Z and inside at Y

68. The section of the neuron that the impulse has reached is

A. W
B. X
C. Y
D. Z

---

69. The hypothalamus is directly connected to the

A. pons
B. pituitary
C. cerebellum
D. medulla oblongata

70. Two functions of the bones are to provide

A. support and protection
B. support and hormone production
C. protection and hormone production
D. protection and blood plasma production

71. In an experiment, a single skeletal muscle cell is electrically stimulated to cause the cell to twitch. As the strength of the electrical stimulus is increased, there will be

A. rapid fatigue of the muscle cell
B. increased strength of contraction
C. increased numbers of muscle twitches
D. the same amount of contraction as before

72. Which part of the skeleton has an immovable joint?

A. Knee
B. Skull
C. Shoulder
D. Vertebrae

73. Normal sperm production is regulated by

A. testosterone
B. Cowper's gland
C. seminiferous fluid
D. the prostate gland

74. An adult male Caucasian who lacks facial hair, has a high-pitched voice, and has an increased subcutaneous layer of fat, likely suffers from insufficient secretion of

A. insulin
B. thyroxin
C. testosterone
D. growth hormone

75. If fertilization of the ovum fails to occur, the corpus luteum will

A. degenerate, accompanied by a drop in progesterone levels
B. degenerate, accompanied by an increase in estrogen levels
C. form from the follicle and begin to secrete luteinizing hormone (LH)
D. form from the follicle and begin to secrete follicle stimulating hormone (FSH)

Use the following information to answer questions 76 to 78.

This chart indicates the relative concentrations of hormones present during a typical menstrual cycle.

Subject	Progesterone	Luteinizing Hormone (LH)	Follicle Stimulating Hormone (FSH)	Estrogen
W	+ + +	+ +	− −	+ +
X	− −	+ + +	+ +	+ + +
Y	+ +	− −	+	+ +
Z	+	+	+ + +	+

NOTE: "+" denotes relative concentration of hormone
"−" denotes trace amount of hormone present

76. In which subject is a new egg starting to develop in the follicle?

A. W
B. X
C. Y
D. Z

77. Which subject is pregnant?

A. W
B. X
C. Y
D. Z

78. Which subject is about to begin menstruation?

A. W
B. X
C. Y
D. Z

79. The human egg is usually fertilized in the

A. ovary
B. uterus
C. oviduct
D. placenta

80. The presence of which hormone in the urine would be an indication of pregnancy?

A. Estrogen
B. Progesterone
C. Follicle stimulating hormone (FSH)
D. Human chorionic gonadotropin (HCG)

YOU HAVE NOW COMPLETED THE MULTIPLE-CHOICE SECTION OF THE EXAMINATION. PLEASE PROCEED TO THE NEXT PAGE AND ANSWER THE WRITTEN-RESPONSE QUESTIONS IN PART B.

PART B

INSTRUCTIONS

Please write your answers in the examination booklet as neatly as possible.

NOTE: The perforated pages at the back of this booklet may be torn out and used for your rough work.

TOTAL MARKS: 20

START PART B IMMEDIATELY

Use the following information to answer question 1.

	Test Tube A	Test Tube B	Test Tube C
Step 1	Add 1 mL of distilled water.	Add 1 mL of amylase solution.	Add 1 mL of boiled amylase solution.
Step 2	Add 10 mL of starch solution.	Add 10 mL of starch solution.	Add 10 mL of starch solution.
Step 3	Let stand for 10 min.	Let stand for 10 min.	Let stand for 10 min.
Step 4	Add 10 drops of Benedict's solution and heat to boiling.	Add 10 drops of Benedict's solution and heat to boiling.	Add 10 drops of Benedict's solution and heat to boiling.

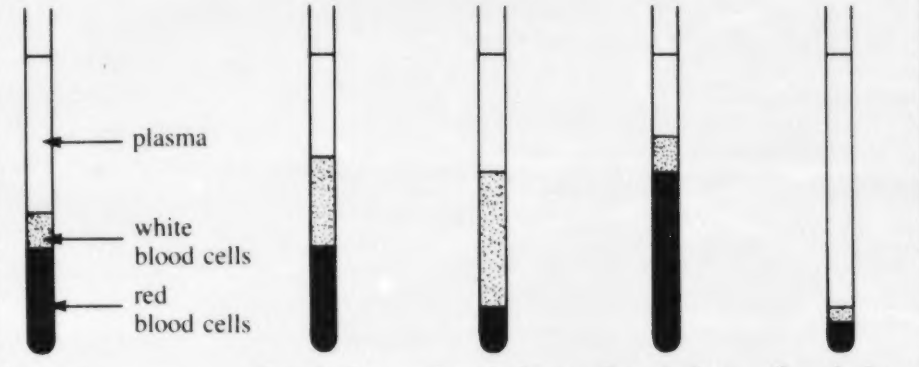
(1 mark) **1.** **a.** State how test tube A serves as a control for the experiment.

(1 mark) **b.** In which of the test tubes would you predict a color change in the solution upon boiling?

(1 mark) **c.** What happens to the enzyme in test tube C?

Use the following information to answer question 2.

Blood that is centrifuged with an anticoagulant can be fractioned into red blood cell, white blood cell, and plasma components. The diagram below represents blood samples taken from various subjects at sea level.



NOTE: Subjects W, X, Y, and Z are suffering from various disorders.

(2 marks) **2. a.** Subject Z is suffering from a bleeding ulcer. Explain how the composition of the blood sample of Subject Z supports this diagnosis.

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(2 marks) **b.** Subject Y is suffering from poor circulation. Explain how the composition of the blood sample of Subject Y supports this diagnosis.

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Use the following information to answer question 3.

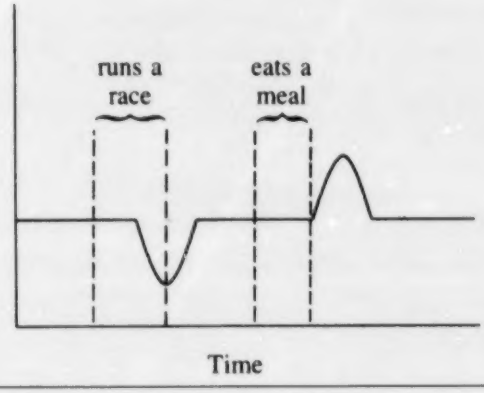
Subject	Glucose in Urine (%)	Protein in Urine (%)	Urine Output (L/day)
A (normal)	0.0	0.0	2
B	0.1	0.0	4
C	0.0	2.0	6
D	0.0	0.0	1
E	0.0	0.0	6

(3 marks) **3.** Which of the subjects suffers from a disorder that is associated with low antidiuretic hormone (vasopressin) secretions? Explain your answer.

(2 marks) **4.** When active transport is occurring in a living membrane, the temperature of that membrane rises slightly. Explain.

Use the following information to answer question 5.

The graph indicates the level of glucose in a student's blood over time.



(2 marks) **5.** **a.** Name the hormone responsible for raising the blood glucose level after the race. Explain its function.

(1 mark) **b.** What hormone is responsible for reducing the glucose level to normal a short time after the meal?

Use the following information to answer question 6.

The chart below indicates the percentage composition of the air inhaled by four people.

Person	% O_2	% CO_2	% N_2
A	21	0.03	78
B	15	0.01	84
C	21	0.01	78
D	21	4.98	74

(3 marks) **6.** Predict which person would have the highest breathing rate. Explain your answer.

(2 marks) **7.** Describe two functions of the placenta.

YOU HAVE NOW COMPLETED THE EXAMINATION. IF YOU HAVE TIME, YOU MAY WISH TO GO BACK AND CHECK YOUR ANSWERS.

TEAR-OUT SHEET

(NO MARKS WILL BE GIVEN FOR WORK DONE ON THIS PAGE)

FOLD AND TEAR ALONG PERFORATION

FOR DEPARTMENT USE ONLY

M1 M2

FOR DEPARTMENT USE ONLY

BIOLOGY 30

(LAST NAME) (FIRST NAME)

NAME:

Y M D

DATE OF BIRTH: SEX:

SCHOOL CODE: SCHOOL: _____

PERMANENT MAILING ADDRESS: _____

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SIGNATURE: _____

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BIOLOGY 30